He then begins with an account of the various branches of the textile and other trades, deeply interesting, not only to those desiring a knowledge of their history, but to all students of the economic position at that time. One curious fact impresses itself on the mind of the reader, that is, how greatly the development of trade was hindered by the very means used to encourage certain particular trades which were protected by Government action. There was certainly no *laissez-faire* in those days.

The most important and most ancient of British manufactures was the woollen industry. It was in a state of great prosperity in the eighteenth century, and was even down to 1770 a domestic industry carried out in the homes of the farmers, who produced the wool, and carded, spun, and wove it into cloth by the help of their families and servants. Nearly all farmers depended on this industry to enable them to pay their rent. For its protection enactments were passed to prevent the export of the raw material; laws were also passed to prevent the mixture of cotton and wool or of linen and wool in weaving fabrics. It was to prevent competition with this valuable trade that one of the Parliaments of that period killed the Irish woollen trade, particularly its blanket trade, by putting an import duty on its goods. Sir Henry Wood does not mention this fact, but he states that the encouragement given to the Irish linen industry was to prevent that country entering into competition with England. In the eighteenth century, as now, Ireland and Scotland seem to have been the chief manufacturers of linen.

Probably it was owing to these repressive regulations that England was one of the last countries to adopt the manufacture of cotton. The skill of her spinners was only equal to producing very coarse cotton yarns. Beautiful muslins and calicoes were imported from India, and became so popular that in 1760 it was made "penal for any woman to wear a dress made of India calico." The wearing of French cambrics was also penal. One of the most fascinating sections of this volume contains the description of the gradual growth of the cotton industry as machinery was invented and perfected.

The making of linen and afterwards of cotton thread was first initiated in the west of Scotland by a woman named Christian Shaw; it rose to be an important trade, even in the eighteenth century, and its products were largely imported to England for purposes of lace making, then chiefly carried on in Devonshire and Bucks.

At the beginning of the century under discussion the manufacture of iron was at a very low ebb. Carried out since Roman times by the use of charcoal derived from wood, it had almost declined entirely owing to the destruction of the woods, and consequent legislative restrictions. The author traces the gradual development of the use of coal for smelting, beginning about 1735, at Coalbrookdale, first of all.

At this same place the method of casting iron was discovered and practised. Sheffield and Birmingham were already making a reputation for metal goods, including pewter, which was much used as a substitute for pottery. Until well into the middle of the century England was mainly dependent on France and Holland for the commonest kinds of earthenware.

Sir Henry Wood tells us that this period, until some time after the middle of the century, was not a happy one for science or for scientific development, and we therefore find that industries dependent on scientific knowledge, such as the making of glass and fine pottery, of brewing and other chemical processes, were in a backward state.

Enough has been said to show what a wealth of material has been skilfully put together, and this book forms a most trustworthy source of information when coming from one who is in such a position as the secretary of the Royal Society of Arts.

SPECTROSCOPY.

The Spectroscope and its Work. By Prof. H. F. Newall, F.R.S. Pp. 163+viii Plates. (London: Society for Promoting Christian Knowledge, 1910.) Price 2*s.* 6*d.*

ALTHOUGH classed as a manual of elementary science, this little volume will be found to cover a very wide range of the phenomena of spectroscopy. The opening chapters are occupied with the first principles of the undulatory theory, Newton's classic experiments, and the description of a simple spectroscopic outfit. In chapters iv. and v. the reader is introduced to the various types of emission spectra shown by radiations from various sources, and to the characteristics of absorption, including the solar fraunhoferic and chromospheric spectra. Chapter vi. deals very lucidly with the theoretical principles to be considered in the design of spectroscopic equipment, showing the relation between angular and linear dispersion, purity and resolving power of various dispersive media, &c. Coming next to the application of the spectroscope to definite branches of research, it is shown how, by the aid of large instruments of special design, the spectra of the stars may be studied, revealing their variation in chemical constitution. This naturally leads to the systems of classification which have been proposed to deal with the complex groupings. In describing the fluted structure of the third-type stars, such as α Orionis, it would have been more correct to speak of the maxima of absorption being nearest to the violet instead of saying that the brighter ends were towards the red, as it is usual to regard the heads of flutings as taken for reference to the positions of flutings. It is also perhaps unfortunate for the student that so much space should be given to the old, incomplete, and now little used classifications, while the more comprehensive and natural systems put forward of recent years are discussed in a few lines. The idea suggested on p. 81 that the maxima of the star Mira (*o* Ceti) are of the nature of a conflagration is scarcely to be recommended, especially when dealing with beginners, as the practically unchanging character of the spectrum of the star (apart from brilliancy) even at maxima precludes the probability of any such chemical changes as must accompany the production of flame.

Chapter viii. is occupied with the method and progress of determining the motions of approach or recession of celestial bodies by Doppler's principle of changes of wave-length.

The great field of solar observation is very efficiently summarised in chapters ix., x., and xi., including the new results obtained by the use of the spectroheliograph (a simple diagram such as is often used would have been of value in rendering the explanation of this instrument much easier); the phenomena of the prominences and reversing layer during a total solar eclipse; the sun's rotation and that of the various planets. In chapter xi. particular attention is given to the spectra of terrestrial atmospheric phenomena by the detection of special features in the solar spectrum at different altitudes.

Chapter xii. is devoted to a short outline of the methods of investigating long wave radiations. The inductive method of presenting the reasoning is very acceptable, and the beginner who has mastered the subject so far will be well equipped for entering on the more advanced branches of this intricate section of spectroscopy.

The concluding three chapters deal with the physical sections of spectroscopy. The various systems of harmonic laws found so closely to represent certain types of spectra are well described. Perhaps in the presentation of the diagrams to illustrate these it would have been preferable to adopt the same scheme of orientation for the spectra. Thus in Fig. 46 the red end is to the right, with all the lines of the series converging to the left or violet; while in Fig. 47 the red end is towards the left, and although the series lines really converge to the violet as before, it is confusing for a beginner to have to find that things are all turned the opposite way. This is all the more important from the fact that there are series actually converging in opposite directions. The phenomena of diffraction and general use of gratings for producing spectra are next given, though necessarily condensed. In a manual avowedly written to induce readers to repeat the experiments, mention might well have been made of the fact that excellent replicas of original Rowland gratings, both plane and concave, are now readily obtainable at a moderate price, as it is not often that an original grating is available for general experimental purposes.

It will have been noticed that the description of the application of the spectroscope has been almost confined to its astronomical aspects; it should not be forgotten that spectroscopic analysis is at present playing an important part in the chemical and metallurgical industries.

Eight plates are given at the end of the book, showing various representative spectra. There is also a large coloured plate as frontispiece showing certain elemental and other spectra.

It will be evident from this summary that the book under review should serve as a most useful introduction to the study of spectrum analysis. It appropriately fills a position between the elementary primer with little or no technical information and the more formidable complete treatises which are admittedly repellent to the beginner.

THE THEORY OF METALLOGRAPHY.

Metallography. By Dr. Cecil H. Desch. Pp. x + 429. (London: Longmans, Green and Co., 1910.) Price 9*s*.

DR. DESCH has evidently been at great pains to compile a work that shall give a fair idea of the subject as a whole as it appeals to him, and he is, above all, a theorist. It is a difficult work for the writer to review, for two reasons: because it covers practically the whole range of this enormous subject and is therefore necessarily dogmatic on many matters that, if disagreeing with the author, it would need much space to discuss adequately; and, secondly, because he dismisses the whole Sheffield School thus:—"This (the Osmond) hypothesis has been generally accepted as the best expression of the known facts, in spite of strong opposition from a (the Sheffield) school of metallurgists . . ." although on pp. 363 and 364 we find rather contradictory opinions, such as "β-iron was originally described by Osmond as a hard variety of iron. It is more correct to say that it is capable of forming solid solutions with carbon, which become hard under certain conditions of cooling."

The "eutectic-times" method for fixing the eutectic composition was used by Arnold in his "Influence of Carbon on Iron" (Proc., Inst. C.E., 1895–6, part i.), although Tammann is credited with its first use in 1903 (p. 18).

The author might with profit study "The Diffusion of Elements in Iron," by Arnold and McWilliam, I.S.I., 1899, No. 1, instead of the preliminary announcement of 1898, which he quotes, and besides further details on diffusion would find that these authors used the quenching method then, in an endeavour to judge of the condition of the carbon, &c., at high temperatures. Also in connection with the method of changing structure from that showing Widmanstätten figures to granular, the author credits the discovery to Fraenkel and Tammann in 1908, whereas the fundamentals of the matter were first published by Arnold and McWilliam in NATURE, November 10, 1904, p. 32.

A good account is given of the diagram of thermal equilibrium, and on p. 32 it is pointed out that the intermetallic compounds do not conform to our ideas of valency.

The sixth chapter is a good one on practical pyrometry and thermal analysis, but actual work on the subject, and recent discussions have surely at last made it plain, that the author is entirely mistaken in his statement on p. 126 that "In accurate work on the transformations of solids, however, one or other of the difference methods is almost invariably adopted." As recently as the Buxton meeting of the Iron and Steel Institute, September, 1910, it was distinctly shown that in a 0·2 per cent. carbon steel the best workers by the difference method do not divide the Ar_2 point, whilst those working with the present modifications of Osmond's inverse-rate method divided the A_2 point with ease, absolutely proving the superiority of the latter method.

Chapters vii. to xiii. deal with the preparation of micro-sections; crystallisation of metals and alloys;